ET 4657-R07

K 3250H INDEXÉ

FORM 1

620626 SPRUSON & FERGUSON

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

APPLICATION FOR A STANDARD PATENT

B.V. Nederlandse Kraanbouw Maatschappij N K M, of Hendrik Figeeweg 1, 2031 BJ Haarlem, THE NETHERLANDS, hereby apply for the grant of a standard patent for an invention entitled:

Device for the Replacement of the Anodes of Electrolytic Cells, in Particular for the Preparation of Aluminium

which is described in the accompanying complete specification.

Details of basic application(s):-

Basic Applic. No:	Country:	Application Date:
8801742	NL	8 July 1988

The address for service is:-

Spruson & Ferguson
Patent Attorneys
Level 33 St Martins Tower
31 Market Street
Sydney New South Wales Australia

DATED this SEVENTH day of JULY 1989

B.V. Nederlandse Kraanbouw Maatschappij N K M

By: J. Erkens

Registered Patent Attorney

TO: THE COMMISSIONER OF PATENTS
OUR REF: 101002
S&F CODE: 58920

3008653 07/07/89
5845/2

COMMONWEALTH OF AUSTRALIA

Patents Act

DECLARATION FOR A PATENT APPLICATION

▼ INSTRUCTIONS

(a) Insert "Convention" if applicable

(b) Insert FULL name(s) of applicant(s)

In support of the [a] Convention application made by [b] B.V. Nederlandse Kraanbouw Maatschappij N K M

(c) Insert "of addition" if applicable

(d) Insert TITLE of invention

(hereinafter called "applicant(s)") for a patent [c] for an invention entitled [d]

Device for the replacement of the Anodes of Electrolytic Cells, in Particular for the Preparation of Aluminium

(e) Insert FULL name(s) AND address(es) of declarant(s) (See headnote e)

I/We [e] Willem Christiaan Hammink

care of B.V. Nederlandse Kraanbouw Maatschappij N K M
Hendrik Figeeweg 1, 2031 BJ Haarlem,
The Netherlands

do solemnly and sincerely declare as follows:

~~1. I am/We are the applicant(s).~~

(or, in the case of an application by a body corporate)

1. I am/~~We are~~ authorized to make this declaration on behalf of the applicant(~~s~~).

~~2. I am/We are the actual inventor(s) of the invention.~~

(or, where the applicant(s) is/are not the actual inventor(s))

(f) Insert FULL name(s) AND address(es) of actual inventor(s)

2. [f] Willem Christiaan Hammink, of Leo Gestelstraat 11, 3443 VR WOERDEN, The Netherlands

(g) Recite how applicant(s) derive(s) title from actual inventor(s) (See headnote e)

is/~~are~~ the actual inventor(~~s~~) of the invention and the facts upon which the applicant(~~s~~) is/~~are~~ entitled to make the application are as follows:

[g] B.V. Nederlandse Kraanbouw Maatschappij N K M, is entitled by Contract of Employment between the inventor as employee and B.V. Nederlandse Kraanbouw Maatschappij N K M as employer, as a person who would be entitled to have the patent assigned to it if a patent were granted upon an application made by the inventor.

*(**Note**: Paragraphs 3 and 4 apply **only** to Convention applications)*

(h) Insert country, filing date, and basic applicant(s) for the/or EACH basic application

3. The basic application(~~s~~) for patent or similar protection on which the application is based is/~~are~~ identified by ***country, filing date, and basic applicant(~~s~~)*** as follows:

[h] The Netherlands
on 8 July 1988
by B.V. Nederlandse Kraanbouw Maatschappij NKM

4. The basic application(~~s~~) referred to in paragraph 3 hereof was/~~were~~ the first application(~~s~~) made in a Convention country in respect of the invention the subject of the application.

(k) Insert PLACE of signing

(l) Insert DATE of signing

(m) Signature(s) of declarant(s)

Declared at [k] Haarlem

Dated [l] 29 June 1989

[m] Hammink, Willem Christiaar

B.V. Nederlandse Kraanbouw Maatschappij N K M

Note: No legalization or other witness required

To: The Commissioner of Patents

(12) PATENT ABRIDGMENT (11) Document No. AU-B-37968/89
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 620626

(54) Title
DEVICE FOR THE REPLACEMENT OF THE ANODES OF ELECTROLYTIC CELLS, IN PARTICULAR FOR THE PREPARATION OF ALUMINIUM

(51)[4] International Patent Classification(s)
C25C 003/12 B66F 007/22 C25C 003/06

(21) Application No. : **37968/89** (22) Application Date : **07.07.89**

(30) Priority Data

(31) Number	(32) Date	(33) Country
8801742	08.07.88	NL THE NETHERLANDS

(43) Publication Date : **11.01.90**

(44) Publication Date of Accepted Application : **20.02.92**

(71) Applicant(s)
B.V. NEDERLANDSE KRAANBOUW MAATSCHAPPIJ N K M

(72) Inventor(s)
WILLEM CHRISTIAAN HAMMINK

(74) Attorney or Agent
SPRUSON & FERGUSON , GPO Box 3898, SYDNEY NSW 2001

(56) Prior Art Documents
AU 614758 18690/88 C25C 3/12
US 3769195

(57) Fig. 1 shows two rows of electrolytic cells 1 and 2, in which anodes 4, 4' fastened to the bars 3, 3' are present. The bars 3, 3' are clamped by clamping elements 5, 5' against the current conductors 6, 6', while the current conductors 6, 6' when in operation are moved extremely slowly downwards by means not shown, so that the distance "d" between the bottom sides of the anodes 4, 4' and the floor 9, 9' always remains constant, despite the fact that the anodes 4, 4' gradually become thinner. The electrolytic cells are covered by covers 7, 7', which are provided with grip elements 8, 8'.

The device for replacement of the anodes 4, 4' comprises a crane bridge made up of two girders 10, 10' which can be moved in the crosswise direction A along the guide tracks 11 supporting the parts 10 and 10' at their ends, and a trolley system 12 which can be moved along the parts 10 and 10' and is provided with wheels 13.

Disposed on the trolley system 12 is a device 14 with a suspended part 14' with a guided load system 14'' which is used to lower e.g. a crucible in which the liquid aluminium formed in the electrolytic cells 1, 2 is drained off, and which is provided with a weighing device, so that the quantity of drained aluminium can be determined directly, following

CLAIM

1. Device for the replacement of anodes of electrolytic cells, in particular for the preparation of aluminium, which are set up in rows spaced apart on a workshop floor, comprising a crane bridge which is disposed above the electrolytic cells and is movable to and fro in the crosswise direction, and has a trolley system which can move along it and on which suspended parts are disposed, said parts comprising a control cab, a breaking device for breaking off the part of the crust lying round an anode on the bath inside an electrolytic cell, a device with a filling pipe for feeding starting material from a bin into an electrolytic cell, and an anode replacement means which is movable up and down, and with which an anode can be lifted from a cell and/or a new anode can be placed, with means for gripping the bar of an anode for detaching the clamping element with which said bar is held against a current conductor and for taking the clamping element back into the working position at the bar of a newly placed anode gripped by the gripping means, wherein the trolley system has fitted on it a turntable structure, which is fitted with the above-mentioned suspended parts essentially distributed along the periphery thereof, all of which can be moved up and down by means of drive means along suspended guide elements disposed on the turntable.

620626

S & F Ref: 701002

FORM 10

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE:

Class Int Class

Complete Specification Lodged:
Accepted:
Published:

Priority:

Related Art:

Name and Address of Applicant:

B.V. Nederlandse Kraanbouw Maatschappij N K M
Hendrik Figeeweg 1
2031 BJ Haarlem
THE NETHERLANDS

Address for Service:

Spruson & Ferguson, Patent Attorneys
Level 33 St Martins Tower, 31 Market Street
Sydney, New South Wales, 2000, Australia

Complete Specification for the invention entitled:

Device for the Replacement of the Anodes of Electrolytic Cells, in Particular for the Preparation of Aluminium

The following statement is a full description of this invention, including the best method of performing it known to me/us

ABSTRACT

Device for the replacement of the anodes of electrolytic cells, in particular for the preparation of aluminium, comprising a crane bridge and a trolley system capable of move along it on which is mounted a turntable structure, which is provided with suspended parts essentially distributed along the periphery thereof, all of which can be moved up and down by means of guide means along suspended guide elements disposed on the turntable said parts, comprising a control cab, a breaking device for breaking off the part of the crust lying round an anode, a device with a filling pipe for feeding starting material from a bin into an electrolytic cell, at least one anode replacement device.

BO 34.905

Device for the replacement of the anodes of electrolytic cells, in particular for the preparation of aluminium.

The invention relates to a device for the replacement of the anodes of electrolytic cells, in particular for the preparation of aluminium, which are set up in rows spaced apart on a workshop floor, comprising a crane bridge which is disposed above the electrolytic cells and is movable to and fro in the crosswise direction, and has a trolley system which can move along it and on which suspended parts are disposed, comprising a control cab, a breaking device for breaking off the part of the crust lying round an anode on the bath inside an electrolytic cell, a device with a filling pipe for feeding starting material from a bin into an electrolytic cell, and an anode replacement device which is movable up and down, and with which an anode can be lifted from a cell and/or a new anode can be placed, with means for gripping the bar of an anode and means for detaching the clamping element with which said bar is held against a current conductor and for taking the clamping element back into the working position at the bar of a newly placed anode gripped by the gripping means. Such a device is known from U.S. Patent Specification 3,769,195.

The metal aluminium is obtained by decomposing pure aluminium oxide in a continuous process with an electric current, in which process this oxide is dissolved in molten cryolite and electrolysed at high temperature in electrolytic cells with carbon anodes, so that the oxide is broken down into metal and oxygen, which combines with the carbon of the anodes to form carbon oxide. The carbon anodes are thus gradually consumed, so that they decrease in thickness, which makes it necessary for the anodes to move downwards continuously in the electrolytic cell (for example, 50 cm in 20 days), in order to keep the distance between the bottom sides of the anodes and the bottom of the electrolytic cells forming the cathode constant, which also means that an anode which at a particular point has reached the smallest permissible thickness has to be replaced shortly afterwards by a new anode.

In the known device for the replacement of anodes the above-mentioned parts are disposed directly on the bottom side of the traversing trolley system, and the control cab and breaking device can each rotate about a vertical axis, while the anode replacement device is fixed on the rotary part of the cab.

This device has the advantage that the bottom ends of the above-mentioned parts lie at such a relatively short distance from the workshop floor that the device cannot be moved over a row of electrolytic cells to the next row of cells by moving the crane bridge, so that before the crane bridge can be moved the traversing trolley system has to be taken to one of the ends of the crane bridge, so that then on displacement of the crane bridge the suspended parts can run through the space between the end of a row of cells and the wall structure supporting the crane bridge. This means that a great enough distance must be maintained between the ends of the rows of cells and the wall structures to pass through the parts suspended from the traversing trolley system, so that the workshop floor cannot be used in the optimum manner. Besides, not all the actions required for the replacement of the anodes can be carried out with the known device from the control cab.

It is the object of the present invention to overcome or substantially ameliorate the above disadvantages.

There is disclosed herein a device for the replacement of anodes of electrolytic cells, in particular for the preparation of aluminium, which are set up in rows spaced apart on a workshop floor, comprising a crane bridge which is disposed above the electrolytic cells and is movable to and fro in the crosswise direction, and has a trolley system which can move along it and on which suspended parts are disposed, said parts comprising a control cab, a breaking device for breaking off the part of the crust lying round an anode on the bath inside an electrolytic cell, a device with a filling pipe for feeding starting material from a bin into an electrolytic cell, and an anode replacement means which is movable up and down, and with which an anode can be lifted from a cell and/or a new anode can be placed, with means for gripping the bar of an anode for detaching the clamping element with which said bar is held against a current conductor and for taking the clamping element back into the working position at the bar of a newly placed anode gripped by the gripping means, wherein the trolley system has fitted on it a turntable

GALIAN

structure, which is fitted with the above-mentioned suspended parts essentially distributed along the periphery thereof, all of which can be moved up and down by means of drive means along suspended guide elements disposed on the turntable.

In a device designed in this way the bottom ends of the above-mentioned parts in their highest position are at such a distance from the workshop floor that the device can be moved from any position over a row of electrolytic cells to a subsequent row.

A device designed in this way also provides the possibility that, in addition to the above-mentioned parts, the turntable can have disposed on it a suspended gripper device which can be moved up and down along the guide elements, and with which the crust parts broken off by the breaking device can be removed from the

cell, and/or that the turntable has fitted on it a suspended device which can be moved up and down along the guide elements for gripping and lifting from an electrolytic cell, or replacing on the cell, at least one cover covering the cell, so that all actions with the device required for the replacement of the anodes can be carried out from the cab.

The drive means for moving the parts up and down are preferably formed by at least one winch or similar device, with a winch drum around which is laid at least one cable or similar element which is connected to the part in question, such drive means being the most reliable in the environment of the electrolytic cells in which relatively high temperatures and magnetic fields prevail.

A device designed in this way according to the invention also provides the possibility of fitting two or more adjacent anode replacement devices on the turntable, so that an anode to be replaced can be removed with one device and a new anode can be placed with the other device.

The guide means for the anode replacement devices can be provided here in an advantageous manner with a screen which can be moved to and fro in the crosswise direction and can be slid under an anode brought up by one of the anode replacement devices, thereby preventing material adhering to the removed anode which has been brought up from dripping down on the workshop floor.

When a new anode is being placed it must be ensured that the bottom side of this anode comes to lie at precisely the same distance as that of the removed anode from the floor of the electrolytic cell. That is why scanning means are preferably provided in at least one anode replacement device on the guide elements for said device, and the winch belonging to this device is provided with a measuring device which can be operated by said scanning means, all this in such a way that while an anode is being brought up out of the cell the measuring device is also put into action until the moment at which the bottom side of the anode has just passed the scanning means, so that the measuring device indicates the distance between the level of the bottom side of this anode in the electrolytic cell and that of the scanning means, and

during lowering of a new anode the measuring device is put into operation at the moment when the bottom side of this anode is at the level of the scanning means, and the lowering movement of the winch is stopped as soon as the measuring device essentially indicates the above-mentioned distance again.

The gripper device advantageously has a bar with a gripper mounted on the end thereof, the bar being provided with an element which can be slid along a lengthwise part of the bar, and which has coupling elements which can be engaged with retaining elements, disposed on the current conductor, for the anode terminals, so that when the coupling elements are engaged with the retaining elements a part of the gripper bar rests with the rear side thereof against the current conductor, and by moving the gripper bar up and down, said rear side, which is roughened or provided with a steel brush, brushes along the current conductor, thereby cleaning the latter.

A suspended protective flap is thereby in an advantageous manner rotatably connected to the guide means for the gripper device, while an operating rod is connected at one end rotatably to the flap and at the other end rotatably to a cam element which can be moved up and down, and the gripper device has a stop which is designed in such a way that on the upward movement of the gripper device this stop comes to rest against the cam element and takes said cam element with it, thereby swinging the protective flap via the operating rod into a horizontal position below the gripper, so that any material which may fall out of the raised gripper falls onto the protective flap.

The filling pipe of the device for supplying the starting material can be slid up and down in an advantageous manner inside a sleeve-type element which is fixed to the outlet of the bin, and into which said outlet opens, while the filling pipe has near its top end an opening, so that in the lowest position of the filling pipe this opening is connected to the mouth in the sleeve-type element of the outlet of the bin.

Since the starting material for the electrolysis comprises two types of material, the bin from which said material can be fed into an electrolytic cell comprises preferably two parts, each having a filling aperture.

In order to be able to replenish this bin with the two types of material from permanently installed supply containers, the filling apertures of the bin must be brought to coincide in the correct manner with the relevant outlet apertures of the supply containers, so that it is impossible for one type of material to go into the part of the bin for the other type of material. The crane bridge and at least one of the guide tracks for it, the traversing trolley system and at least one of the guide tracks provided for it on the crane bridge and the turntable and the circular guide track provided for it on the traversing trolley system are therefore advantageously provided with limit switch units to make it possible for the filling apertures of the bin to be taken into the correct position relative to the feed apertures of the permanently installed supply containers.

A preferred form of the present invention will now be described by way of example with reference to the accompanying drawings, wherein:

Fig. 1 shows in side view, along I-I in Fig. 2, a device according to the invention for the replacement of the anodes in electrolytic cells;

Fig. 2 shows a top view of said device;

Fig. 3 shows schematically in perspective the turntable system of the device according to Figs. 1 and 2;

Figs. 4a and 4b show schematically the control cab in the highest and lowest positions respectively relative to the electrolytic cells;

Fig. 5 shows the cab structure in side view;

Fig. 6 shows a top view of the cab structure;

Fig. 7 shows schematically the device for removing and replacing the covers covering the electrolytic cells;

Figs. 8a and 8b show the device according to Fig. 7 in the lowest and highest position respectively;

Fig. 9 shows schematically the gripper device;

Figs. 10a and 10b show the gripper device in the lowest and highest position respectively;

Fig. 10c shows the encircled part in Fig. 10 in greater detail.

Fig. 11 shows schematically the breaker device;

Fig. 12 shows schematically the anode replacement devices;

Figs. 13a, 13b, 13c show three stages in the replacement of an anode;

Fig. 14 shows schematically the filling device; and Fig. 15 shows schematically in top view the different limit switch units for positioning the filling apertures of the bin.

Fig. 1 shows two rows of electrolytic cells 1 and 2, in which anodes 4, 4' fastened to the bars 3, 3' are present. The bars 3, 3' are clamped by clamping elements 5, 5' against the current conductors 6, 6', while the current conductors 6, 6' when in operation are moved extremely slowly downwards by means not shown, so that the distance "d" between the bottom sides of the anodes 4, 4' and the floor 9, 9' always remains constant, despite the fact that the anodes 4, 4' gradually become thinner. The electrolytic cells are covered by covers 7, 7', which are provided with grip elements 8, 8'.

The device for replacement of the anodes 4, 4' comprises a crane bridge made up of two girders 10, 10' which can be moved in the crosswise direction A along the guide tracks 11 supporting the parts 10 and 10' at their ends, and a trolley system 12 which can be moved along the parts 10 and 10' and is provided with wheels 13.

Disposed on the trolley system 12 is a device 14 with a suspended part 14' with a guided load system 14'' which is used to lower e.g. a crucible in which the liquid aluminium formed in the electrolytic cells 1, 2 is drained off, and which is provided with a weighing device, so that the quantity of drained aluminium can be determined directly, following which the full crucible can be taken to a casting device.

The trolley system 12 also has mounted on it a turntable 15 which by means of wheels 16 can turn through 400° along a circular track 15' fitted on the trolley system 12, so that a fixed electrical connection without sliding contacts between switch boxes fitted on the crane bridge and the cab 18' can be obtained.

A number of guide elements 17, 171.....176 are suspended from the turntable unit 15, along its periphery, to form guide tracks for the different parts suspended from the turntable unit, i.e. a

control cab unit 18, a breaking device 19, a device 20 for gripping, removing and replacing a cover 7, 7', two adjacent anode replacement devices 21 and 22, a filling pipe 23 and a gripper device 24, and these parts can be moved up and down by means of the winches 25, 251.....255 mounted on the turntable unit, the cables running round the winches being connected to the relevant parts. For the sake of clarity, the guide elements 17, 171.....176 are shown singly, but in reality they each consist of two parts, so that two guide elements are present for each part mentioned.

A circular platform 26 is fixed on the guide elements 17, ...176. As shown in Figs. 5 and 6, the cab unit 18 comprises the actual cab 18' which is suspended by means of flexible hangers 27 from a guide frame 28 which is guided between the guide elements 17 and 171. The frame 28 is suspended from two cables 25' of the winch 25, so that the safety regulations for passenger lifts are met. An air conditioning unit 29 with a fan 29' is also fitted for maintaining the inside of the cab 18' at a pleasant temperature. This unit 29 also has a tank (not shown) for collection of condensation, and a pump with an atomizer by means of which this water can be atomized in the environment.

As shown in Figs. 4a and 4b, the cab 18' can be moved from the highest position shown in Fig. 4a to the lowest position shown in Fig. 4b and back, in the lowest position the operator in the cab 18' having a good view of the electrolytic cells 1 and 2, as shown by dotted lines. In the raised position the cab 18' can be transferred over a row of electrolytic cells to another row.

As shown in Fig. 7, the device 20 for the gripping, lifting and replacing of an electrolytic cell cover 7 and 7' has three grip elements 30, 30' and 30'', which can each be placed under a gripping part 8, 8' of a cover 7, 7', as shown in Fig. 8a. The central gripping element 30 is connected rotatably about a shaft 31 to a central part 32 which is fixed on the suspended part 33' of the guide element 33. The outer gripping elements 30' and 30'' are each connected rotatably about a shaft 31 and 31'' respectively to L-shaped side pieces 34 and 34', which are connected by means of the parallelogram linkages 35 and 35' to the central part 32. The side pieces 34, 34' can be raised by means of lifting devices, for

example the piston/cylinder units 36, 36', as shown for the side piece 34', making the whole device 20 shorter in length, what is important in the treatment of electrolytic cells where the working space gives less room. Disposed on projecting ends of the shafts 31, 31' and 31'' are follower rollers 37, 37' and 37''', which come into contact with the ramps 38 and 38 when the device 20 is raised, which causes the gripping elements 30, 30' and 30'' to be swung up round the shafts 31, 31' and 31'', thereby causing a gripped cover 7 to hang in a vertical position from the device 20, as shown in Fig. 8b. The ramps 38 and 38' are fixed on the guide elements 172, 173, between which the guide element 33 is guided. This element 33 is suspended from the cable 252' of the winch 252.

As shown in Fig. 9, the gripper device 24 has a grab 24' fixed on a bar 39'. The bar 39 is connected to a guide member 40 which is guided between the guide elements 175 and 176 and is suspended from the cable 255' of the winch 255. A suspended flap 41 is rotatably connected at 41', in a manner not shown further, to the guide elements 175 and 176. A control rod 42 is rotatably fixed on the flap 41, and at its other end is rotatably connected to a cam element 43 which at 43' is rotatably connected, in a manner not further shown, to the guide elements 175 and 176, and which is supported at 43''. When the guide member 40 is now raised, the flap 41 will be swung by means of the cam element 43 and the control rod 42 into a horizontal position in which the flap is under the gripper 24'. A slide piece 44 with projecting pins 44' which can slide a certain distance along the bar 39 is disposed round the bar 39. On lowering of the gripper device 24 the projecting pins 44' of the slide piece 44 can engage with the hooks 45, as shown in Fig. 10c. These hooks 45 are fixed on the current conductor 6 and serve to retain a clamping element 5 which is removed when the gripper device is put into operation. In the position shown in Fig. 10c the rear side 39' of the gripper bar 39, which is roughened or provided with a steel brush, lies against the front side of the current conductor 6, so that when the bar 39 is moved up and down, this front side of the current conductor 6 is brushed clean. The grab 24' shown can if necessary be replaced by a crushing device.

As shown in Fig. 11, the breaking device 19 comprises a breaking chisel 19' which is fixed by means of the parallelogram linkages 46 and 46' to the suspended bar 47 of the slide element 47' which is disposed for a sliding movement between the guide elements 171 and 172. The slide element 47' is suspended by means of the cable 251' from the winch 251. The breaking chisel 19' can be moved by means of the piston/cylinder unit 48 from the shown operating position into the rest position shown by dotted lines, and vice versa. The piston/cylinder unit 48 is made double, so that in the working position the breaking chisel 19' can be moved up and down with a relatively short stroke to break the crust.

As shown in Fig. 12, the anode replacement devices 21 and 22 each have a gripping head 21', 22' for gripping the bar 3 of an anode 4, and a screw element 21'', 22'' for releasing a clamping element 5. The device 21 also has a slide element 49 which is provided so that it slides between the guide elements 173 and 174, and which is suspended from the cable 253' of the winch 253, while the device 22 has a slide element 50 which is provided between the guide elements 175 and 176 and is suspended from the cable 254' of the winch 254. A cable 51' which is guided round a counter 51, and from which a weight 51'' is suspended, is also fixed on the slide element 49. A cable 52' which is guided round a counter mechanism 52 and from which a weight 51'' is also suspended is fixed on the slide element 50. A frame 53 along which a screen 54 can slide to and fro is fixed on the bottom ends of the guide elements 173, 174, 175, so that this screen 54 can be slid under an anode 4' which has been brought up, as shown for the device 22 in Fig. 12.

A laser device 55 and a laser sensor 55' are also provided on the frame 53. If now, as shown in Fig. 13a, an anode 4 has to be lifted by means of the device 22 from the electrolytic cell, the counter mechanism 52 will be put into operation during the raising of this anode up to the time that the bottom side of the anode passes the laser beam emitted by the device 55, as shown in Fig. 13b, at which moment the counter mechanism is stopped. While the device 21 is lowering the new anode 4' suspended therefrom, it will put the counter mechanism 51 into operation the moment the bottom side of this anode 4' interrupts the laser beam, and the lowering

movement of the device is stopped the moment the counter 51 has carried out the same number of counts as the counter 52 during bringing up of the anode 4. In this way it is ensured, as shown in Fig. 13c, that the newly fitted anode 4' rests with its bottom side at essentially the same distance from the ground as the removed anode 4. It is also possible to stop the lowering movement of the device 21' after the counter 51 has carried out a set number of counts, so that the anode 4' then comes to rest with its bottom side at a set distance from the ground.

As shown in Fig. 14, the filling pipe 23 can be moved up and down by means of the winch 256 and the winch cable 256', in which process this pipe 23 can slide inside a sleeve-shaped element 56 into which an outlet 57 of a metering and mixing device 58 opens, so that in the lowered position shown the top side of the filling pipe 23 is in open connection with outlet 57, and in the raised position shown by dotted lines the outlet 57 is blocked. The metering and mixing device 58 is connected to the outlets 59 and 59' of the bin 60, which is fitted on the turntable 15 and is divided into two parts, one part with the outlet 59 and a filling aperture 61, and another part with the outlet 59' and a filling aperture 61', while the filling apertures 61 and 61' lie in the centre of the turntable 15 and by means of the bellows 60' can be moved up and down relative to the bin 60, so that for replenishing the bin 60 from a supply container 62 (see Fig. 15) the filling apertures 61, 61' can be raised until they rest against the discharge apertures of the supply container 62 for dust-free replenishment of the bin 60.

In order to be able to replenish the bin 60 in the correct manner with the two types of basic material from the supply container 62 (see Fig. 15) which is disposed at a fixed point, these filling apertures 61 and 61' must be brought accurately to coincide with the discharge apertures 63, 63' of the supply container. For this purpose, staggered strips 64 and 64' are disposed at the guide track for the crane bridge 10, 10', so that when one of two position sensors connected to the crane bridge leaves the strip 64 and the other sensor comes to rest exactly opposite the strip 64', the centre point of the filling apertures

61, 61' lies accurately on the line I.

Strips 65 and 65' which are staggered relative to one another are also disposed on one of the guide tracks for the trolley system 12, so that when, during a movement in the direction of the arrow B, one of the two position sensors connected to the trolley system 12 leaves the strip 65 and the other sensor has just arrived opposite the strip 65', the centre point of the filling apertures 61, 61' lies precisely on the line II. Thereafter it must be ensured that the filling apertures 61 and 61' come to rest opposite the appropriate discharge apertures 63, 63' of the supply container, for which purpose provision is made along the guide track 15' (see Fig. 2) of the turntable 15 for pairs of strips 66, 66' and 67, 67' which can be scanned by the position sensors 68 disposed on the turntable, so that when the sensors pass from the strip 66' to the strip 66 during the rotary movement of the turntable 15 in one direction, or the sensors 68 pass from the strip 67' to the strip 67 during a rotary movement in the other direction, the filling apertures 61 and 61' are in the correct position, as shown in Fig. 15, relative to the discharge apertures 63 and 63' of the supply container.

The valves shutting off the discharge apertures 63, 63' of the stock container 62 are operated by control cylinders which are fitted on the bin 60 and are situated in such a way relative to each other that they can control the appropriate valves only when the filling apertures 61 and 61' coincide with the discharge apertures 63 and 63' respectively.

When the device is in operation the cover 7 of the electrolytic cell is first lifted off and brought up by means of the device 20. Thereafter the crust round the anode 4 in question is broken by means of the device 19. The anode in question can then be lifted out of the cell by means of one of the devices 21 or 22. The crust parts which have been broken off are then removed by means of the gripper device 24, and a new anode is placed in the cell and fixed with the other one of these devices, following which basic material is placed round this anode in the cell by means of the filling pipe 23. Finally, the cover 7 is replaced. During these operations the cab 18' can be in its lowest position and can turn

with the turntable 15.

The claims defining the invention are as follows:

1. Device for the replacement of anodes of electrolytic cells, in particular for the preparation of aluminium, which are set up in rows spaced apart on a workshop floor, comprising a crane bridge which is disposed above the electrolytic cells and is movable to and fro in the crosswise direction, and has a trolley system which can move along it and on which suspended parts are disposed, said parts comprising a control cab, a breaking device for breaking off the part of the crust lying round an anode on the bath inside an electrolytic cell, a device with a filling pipe for feeding starting material from a bin into an electrolytic cell, and an anode replacement means which is movable up and down, and with which an anode can be lifted from a cell and/or a new anode can be placed, with means for gripping the bar of an anode for detaching the clamping element with which said bar is held against a current conductor and for taking the clamping element back into the working position at the bar of a newly placed anode gripped by the gripping means, wherein the trolley system has fitted on it a turntable structure, which is fitted with the above-mentioned suspended parts essentially distributed along the periphery thereof, all of which can be moved up and down by means of drive means along suspended guide elements disposed on the turntable.

2. Device according to Claim 1, wherein the turntable can have disposed on it a suspended gripper device which can be moved up and down along guide elements, and with which the crust parts broken off by the breaking device can be removed from the cell.

3. Device according to Claim 1 or Claim 2, wherein the turntable has fitted on it a suspended device which can be moved up and down along guide elements for gripping and lifting from an electrolytic cell, or replacing on the cell, at least one cover covering the cell.

4. Device according to any one of Claims 1 to 3, wherein the drive means comprises at least one winch or similar device with a winch drum around which is laid at least one cable or similar element which is connected to the part in question.

5. Device according to any one of Claims 1 to 4, further comprising two adjacent anode replacement devices.

6. Device according to Claim 5, wherein the guide means for the anode replacement devices are provided with a screen which can be moved

to and fro in the crosswise direction and can be slid under an anode brought up by one of the anode replacement devices.

7. Device according to Claim 5 or Claim 6, wherein scanning means are provided in at least one anode replacement device on the guide elements for said device, and the winch belonging to this device is provided with a measuring device which can be operated by said scanning means, all this in such a way that while an anode is being brought up out of the cell the measuring device is also put into action until the moment at which the bottom side of the anode has just passed the scanning means, so that the measuring device indicates the distance between the level of the bottom side of this anode in the electrolytic cell and that of the scanning means, and during lowering of a new anode the measuring device is put into operation at the moment when the bottom side of this anode is at the level of the scanning means, and the lowering movement of the winch is stopped as soon as the measuring device essentially indicates the above-mentioned distance again.

8. Device according to any one of Claims 2 to 7, wherein the gripper device has a bar with a gripper mounted on the end thereof, the bar being provided with an element which can be slid along a lengthwise part of the bar, and which has coupling elements which can be engaged with retaining elements disposed on the current conductor for the anode terminals, so that when the coupling elements are engaged with the retaining elements a part of the gripper bar rests with the rear side thereof against the current conductor, and by moving the gripper bar up and down, said rear side, which is roughened or provided with a steel brush, brushes along the current conductor, thereby cleaning the latter.

9. Device according to any one of Claims 2 to 8, wherein a suspended protective flap is rotatably connected to the guide means for the gripper device, while an operating rod is connected at one end rotatably to the flap, and at the other end rotatably to a cam element which can be moved up and down, and the gripper device has a stop which is designed in such a way that on the upward movement of the gripper device this stop comes to rest against the cam element and takes said cam element with it, thereby swinging the protective flap via the operating rod into a horizontal position below the gripper.

10. Device according to any one of Claims 1 to 9, wherein the filling pipe of the device for supplying the starting material can be

TRALIAN

slid up and down in an advantageous manner inside a bush-type element which is fixed to the outlet of the bin, and into which said outlet opens, while the filling pipe has near its top end an opening, so that in the lowest position of the filling pipe this opening is connected to the mouth in the bush-type element of the outlet of the bin.

11. Device according to any one of Claims 1 to 10, wherein the bin from which basic material can be fed into an electrolytic cell is in two parts, each of which has a filling aperture.

12. Device according to Claim 11, wherein the crane bridge and at least one of the guide tracks for it, the trolley system and at least one of the guide tracks provided for it on the crane bridge and the turntable and the circular guide track provided for it on the trolley system are provided with limit switch units to make it possible for the filling apertures of the bin to be taken into the correct position relative to the feed apertures of the permanently installed stock containers.

13. A device substantially as hereinbefore described with reference to the accompanying drawings.

DATED this THIRD day of DECEMBER 1991

B.V. Nederlandse Kraanbouw Maatschappij N K M

Patent Attorneys for the Applicant
SPRUSON & FERGUSON

TRALIAN

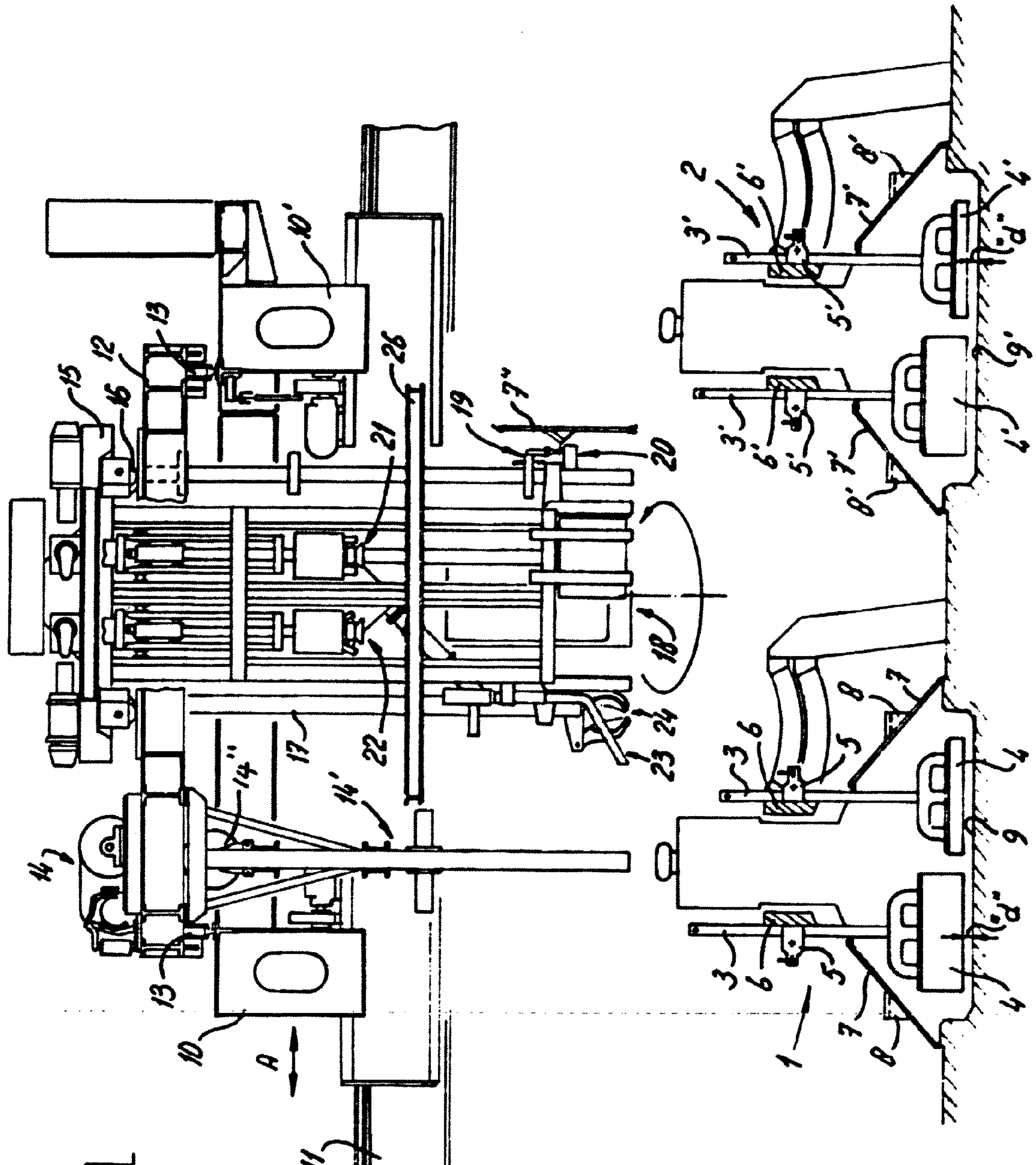

1
2
3
3'
4
4'
5
5'
6
6'
7
7'
7''
8
8'
9
9'
10
10'
11
12
13
14
14'
14''
15
16
17
18
19
20
21
22
23
24
26
A
d''

Fig-1

fig-2

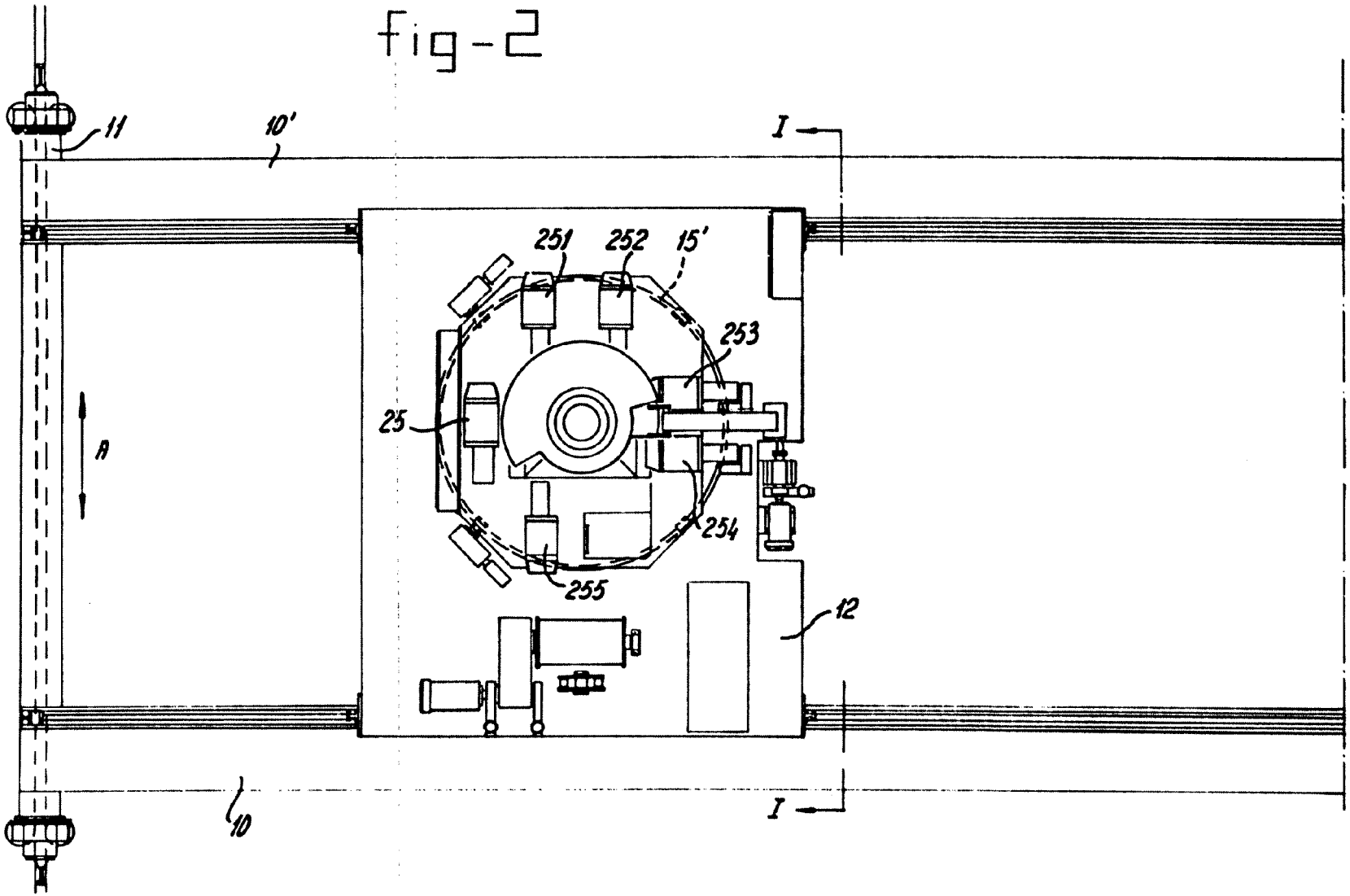


Fig-4a

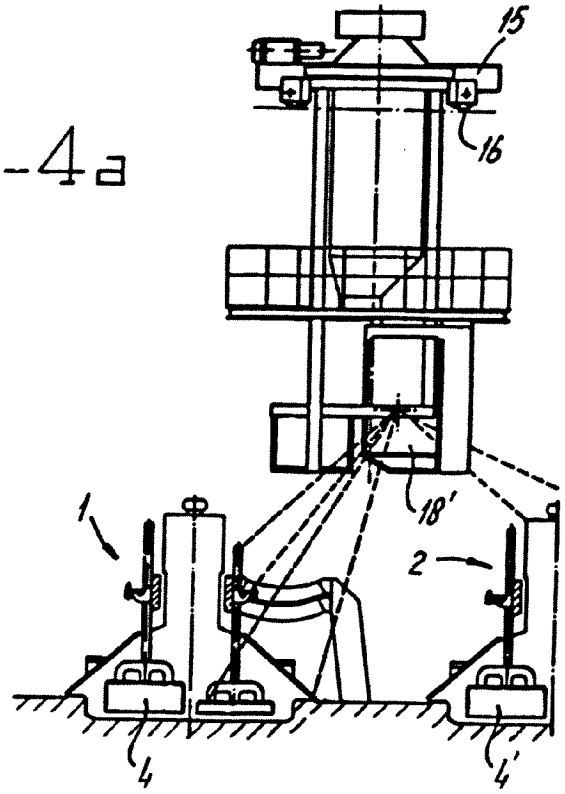


Fig-3

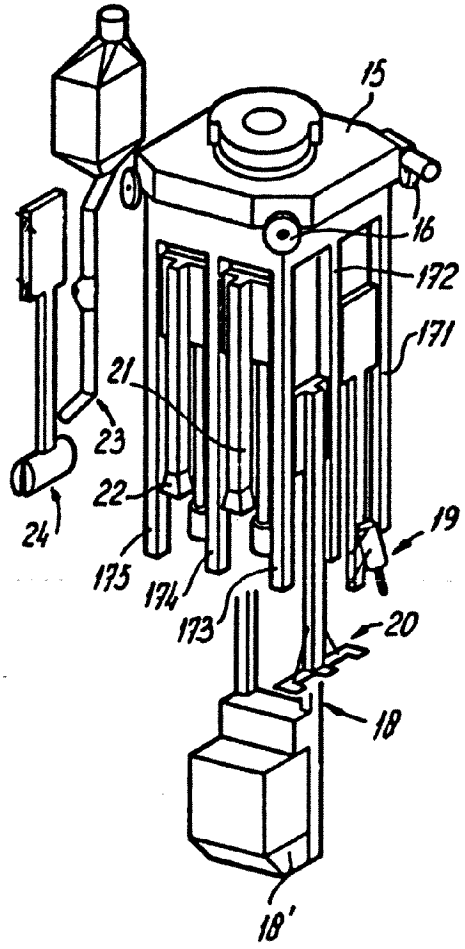


Fig-4b

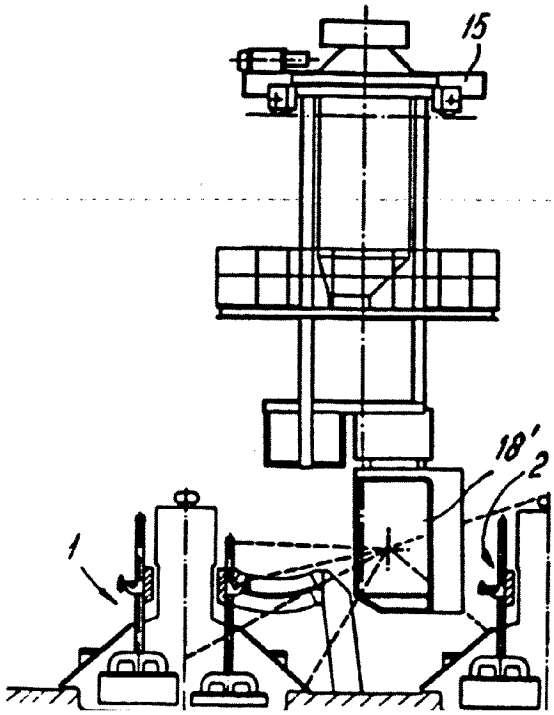


Fig-5

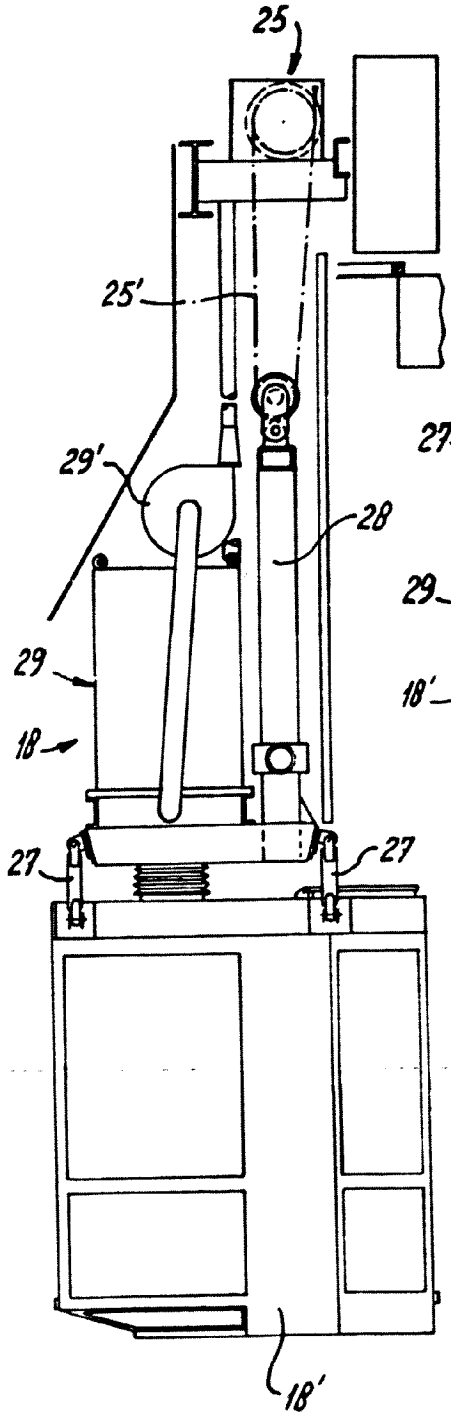


Fig-6

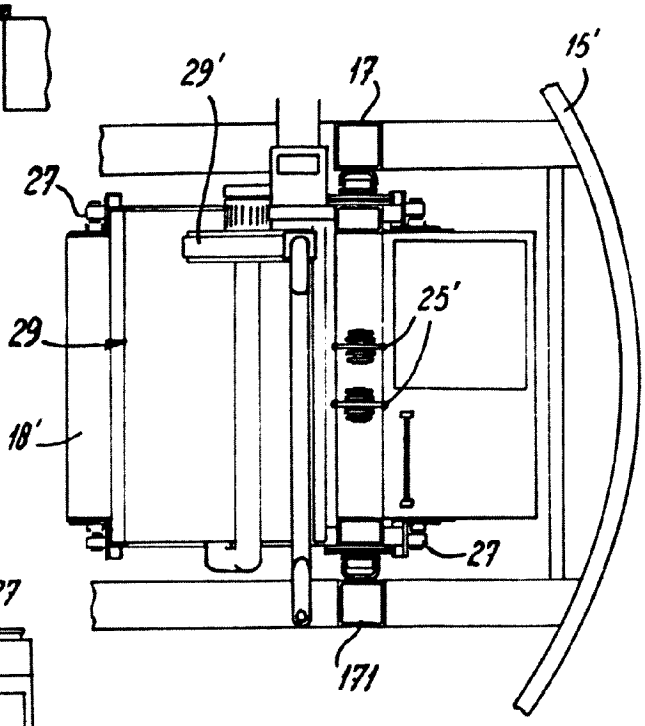


Fig - 7

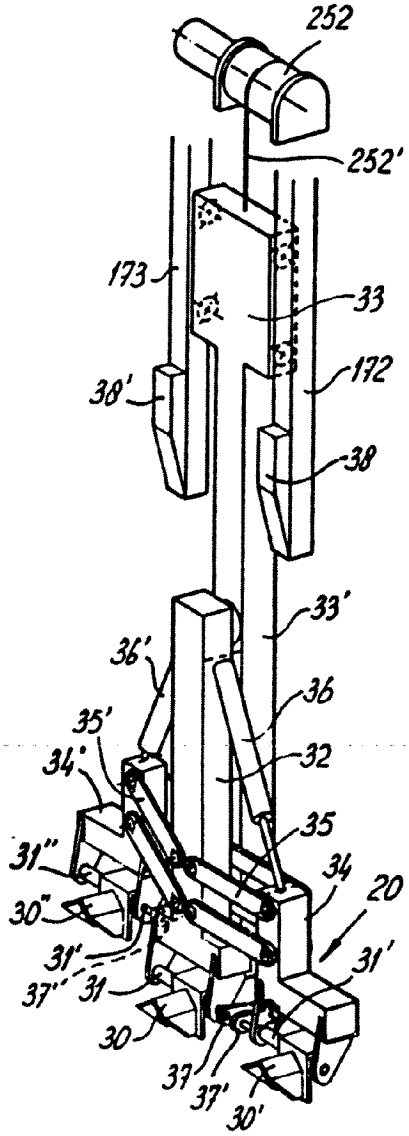


Fig - 8a

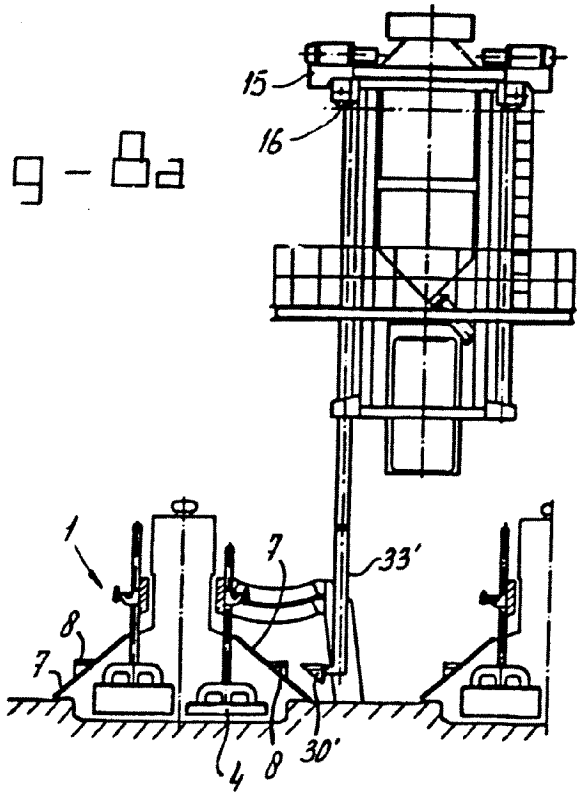


Fig - 8b

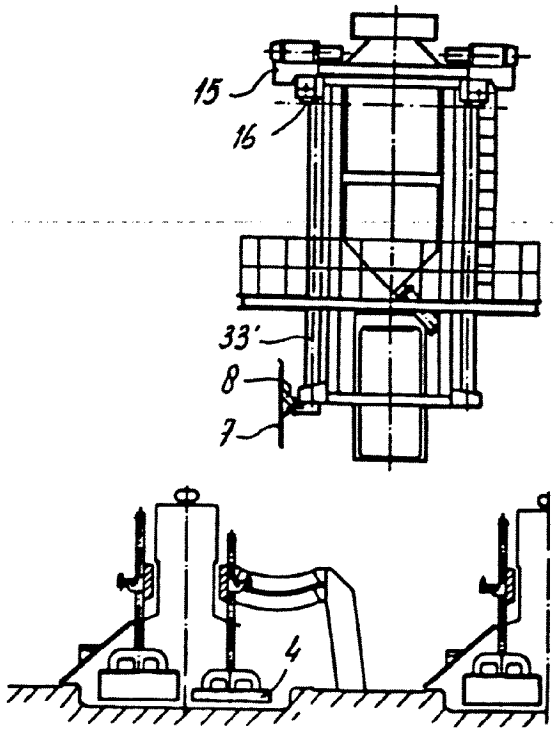


fig - 10a

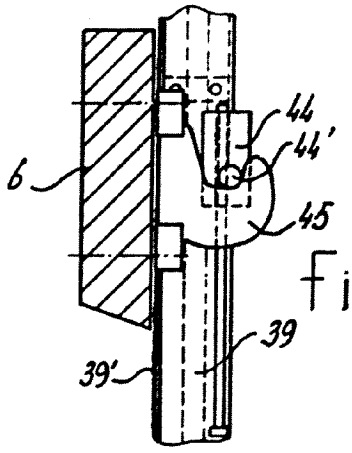
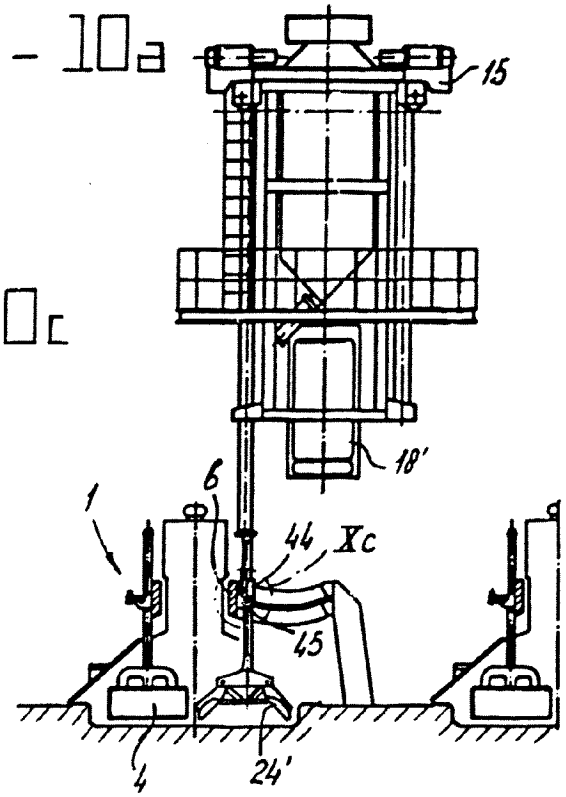


fig - 10c



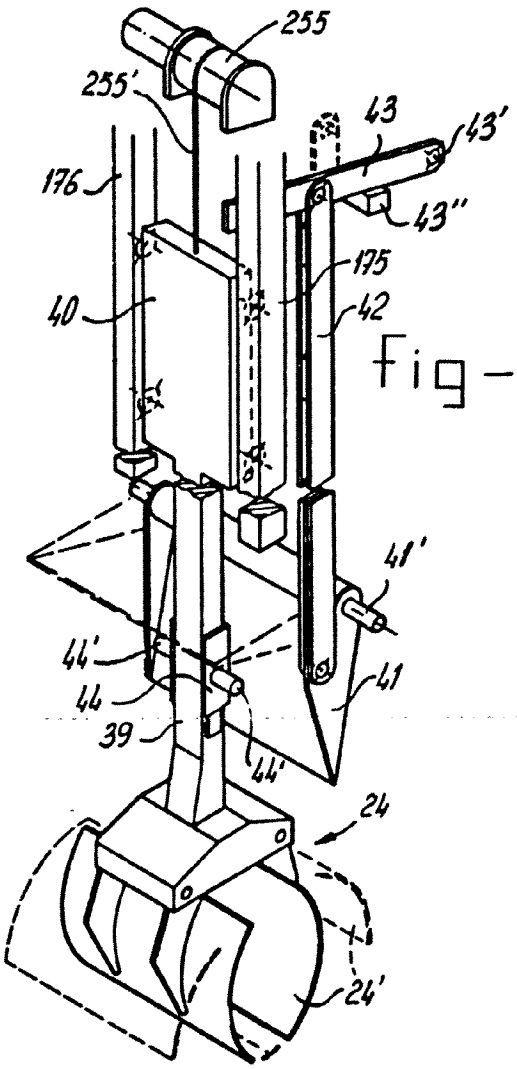


fig - 9

fig - 10b

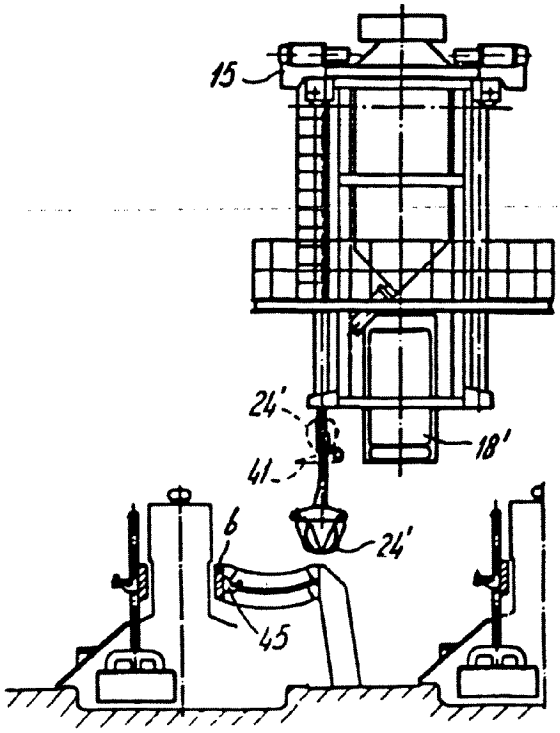


Fig - 12

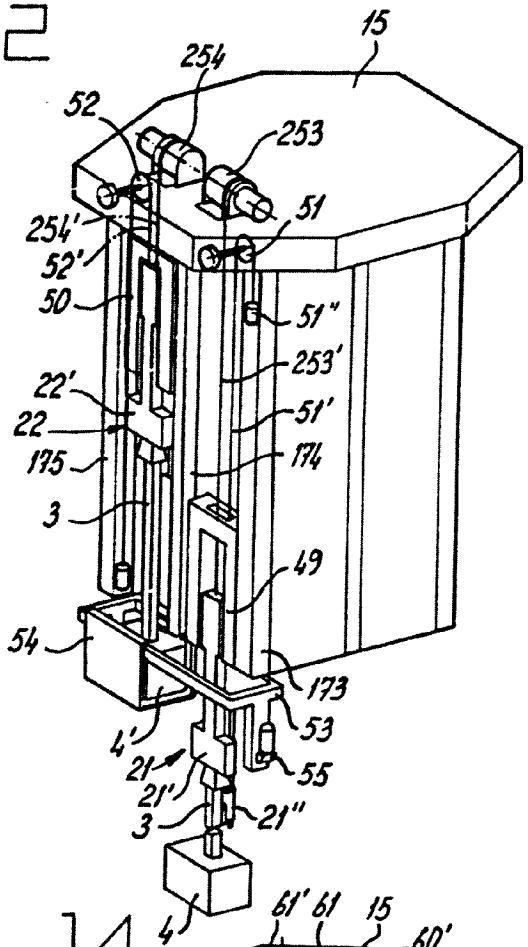


Fig - 11

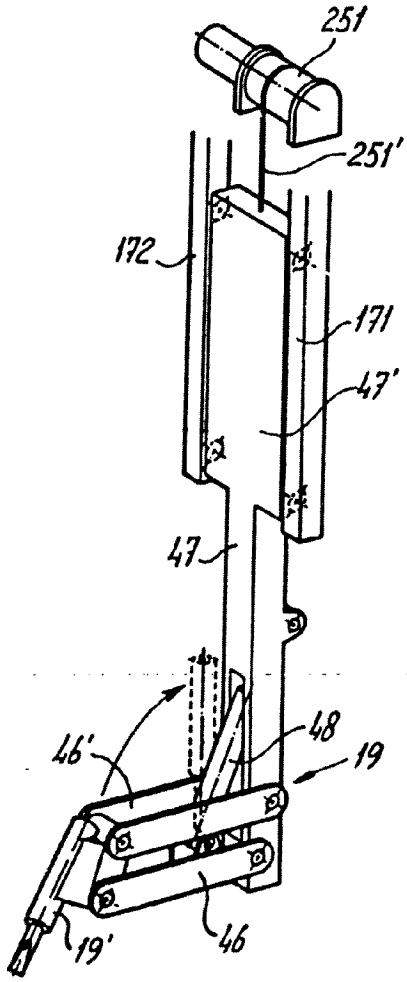


fig - 14

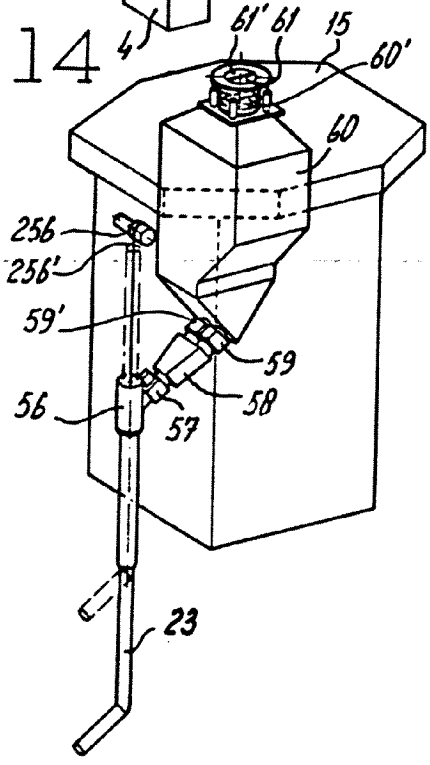


fig - 13a

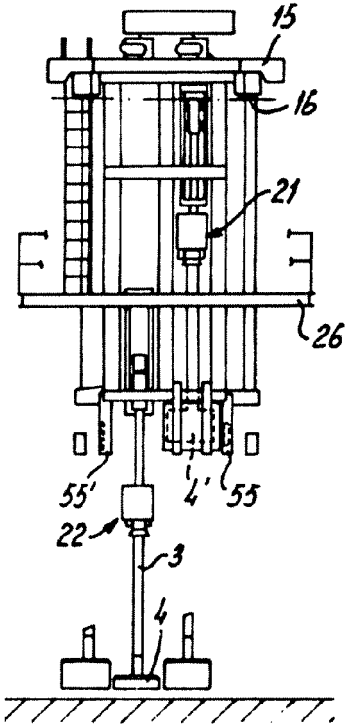


fig - 13b

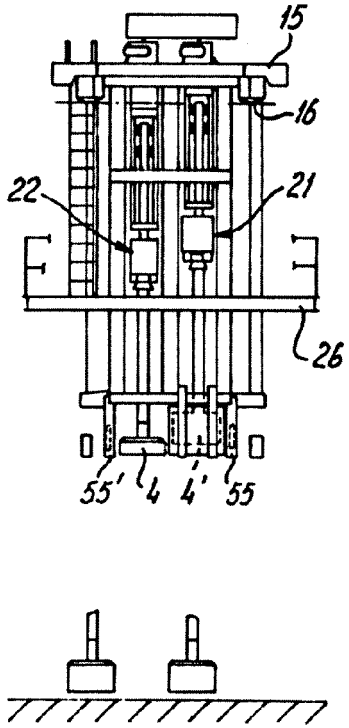
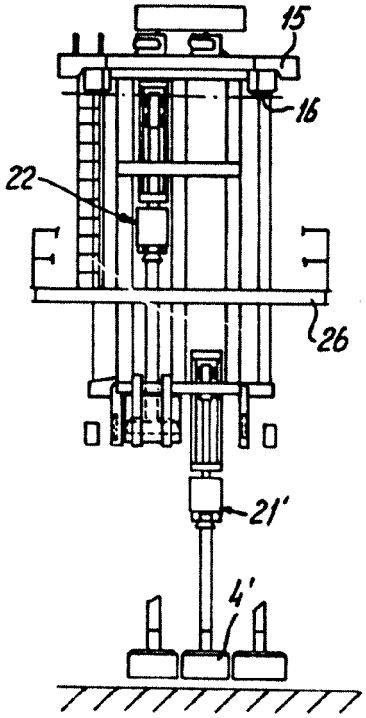


fig - 13c



7 703 3963

fig-15